

# PATENT ABSTRACTS OF JAPAN

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(71)Applicant : **MATSUSHITA ELECTRIC WORKS LTD**

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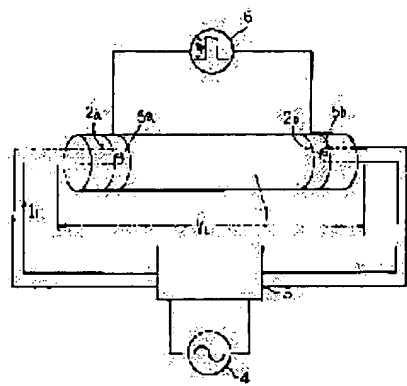
(72)Inventor : **TAGUCHI NORIYUKI  
UETSUKI TADAO**

## (54) FLUORESCENT LAMP

(57)Abstract:

PURPOSE: To enhance the efficiency of a fluorescent lamp to a great extent.

CONSTITUTION: A fluorescent lamp is high-frequency lighted with a high frequency voltage impressed on a pair of internal electrodes 2a, 2b, wherein a pair of external electrodes 5a, 5b are installed on the outside of the tube 1 in positions near the internal electrodes 2a, 2b, and further a pulse generating circuit 6 is furnished to impress a pulse voltage between the external electrodes 5a, 5b, and thereby a wave motion is excited in a discharge plasma. Accordingly the 254-nm emission intensity can be increased by impressing pulse voltage on the external electrodes for excitation of wave motion in the discharge plasma, and the light emitting efficiency is enhanced.



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**CLAIMS**

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[Claim(s)]

[Claim 1] A fluorescent lamp characterized by having a pulse generating circuit which impresses a pulse voltage for exciting a wave motion inside discharge plasma to said external inter-electrode one while equipping said location near the internal electrode of an outside of a lamp pipe with an external electrode of a pair in a fluorescent lamp by which RF lighting is carried out with high-frequency voltage impressed to an internal electrode of a pair.

[Claim 2] A fluorescent lamp characterized by having a pulse generating circuit which impresses a pulse voltage for exciting a wave motion inside discharge plasma between said external electrodes and said one internal electrodes while equipping one near location of said internal electrode with an external electrode on the outside of a lamp pipe in a fluorescent lamp by which RF lighting is carried out with high-frequency voltage impressed to an internal electrode of a pair.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the method of raising especially lamp efficiency about the so-called fluorescent lamp that mercury and rare gas were enclosed in the pipe.

[0002]

[Description of the Prior Art] In the so-called fluorescent lamp with which mercury and rare gas were enclosed in the pipe, current and the maximum efficiency acquired are set to the fluorescent lamp only for RF lightings. It is a 100 lm/W degree. However, improvement in the further effectiveness is desired rather than the viewpoint of energy saving. As an approach for current and efficient-izing currently performed, they are optimization of a lamp size, optimization of the lighting method represented by RF lighting, improvement in the luminous efficiency of a fluorescent substance, etc.

[0003]

[Problem(s) to be Solved by the Invention] However, in the present condition, there was a trouble that large improvement in efficiency was not easy, only by the above-mentioned method.

[0004] This invention was made in view of the above-mentioned technical problem, and the place made into the purpose is by controlling the discharge plasma positively to offer the structure of a fluorescent lamp where large improvement in effectiveness can be aimed at.

[0005]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, a fluorescent lamp according to claim 1 is characterized by having a pulse generating circuit which impresses a pulse voltage for exciting a wave motion inside discharge plasma to said external inter-electrode one while equipping said location near the internal electrode of an outside of a lamp pipe with an external electrode of a pair in a fluorescent lamp by which RF lighting is carried out with high-frequency voltage impressed to an internal electrode of a pair.

[0006] Moreover, a fluorescent lamp according to claim 2 is characterized by having a pulse generating circuit which impresses a pulse voltage for exciting a wave motion inside discharge plasma between said external electrodes and said one internal electrodes while it equips one near location of said internal electrode with an external electrode on the outside of a lamp pipe in a fluorescent lamp by which RF lighting is carried out with high-frequency voltage impressed to an internal electrode of a pair.

[0007]

[Function] In the fluorescent lamp turned on by the choke coil or the inverter method, the fluorescent lamp of this invention installs an external electrode in the exterior of the pipe of a lamp, and is characterized by impressing a predetermined repeat pulse voltage to the external electrode. Thus, by constituting, the electron of energy is generable inside the plasma in a pipe. Mercury can be excited to level with more high energy levels with this electron. The mercury excited by these high energy levels emits ultraviolet rays to the quiescent time of a pulse voltage. This is the same phenomenon as the afterglow in the pulse discharge generally said, and if the conditions of an impression pulse are optimized, it is known that bigger intensity of radiation than under pulse impression can be obtained.

[0008] Moreover, by impressing a pulse voltage to an external electrode, as shown in drawing 3, vibration arises in the voltage waveform of internal inter-electrode discharge, and a current wave form. When it means that the wave motion is excited and this wave motion exists in the interior of the discharge plasma, 254nm intensity of radiation increases this vibration.

[0009]

[Example] One example of the fluorescent lamp of this invention is explained based on the circuit diagram of drawing 1. By drawing 1, internal electrode 2a of a pair and 2b are installed in the interior of the lamp pipe 1 with which mercury and rare gas were enclosed, and internal electrode 2a and 2b are connected to the lighting circuits 3, such as choke ballast or an inverter method, respectively. The lighting circuit 3 has inputted alternating current power from the source power supply 4. The external electrodes 5a and 5b are attached in the location near internal electrode 2a of lamp pipe 1 outside, and the 2b, respectively, and those external electrodes 5a and 5b are connected to the pulse generating circuit 6.

[0010] While constituting as mentioned above and impressing high-frequency voltage between internal electrode 2a and 2b by the lighting circuits 3, such as choke ballast or an inverter method, the pulse voltage whose frequency is about 40Hz is impressed between external electrode 5a and 5b by the pulse generating circuit 6. The voltage between internal electrode 2a at

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this time and 2b or the wave of current comes to be shown in drawing 3 .

[0011] At drawing 3 , (a) is lamp voltage impressed between internal electrode 2a and 2b. VL (b) is the voltage waveform to express and lamp current which flows between internal electrode 2a and 2b. IL (c) is the current wave form to express and a pulse voltage impressed between external electrode 5a and 5b. VP It is the voltage waveform to express. Pulse voltage as are shown in drawing 3 and shown in (c) VP It is lamp voltage as it is shown in (a) and (b), when it impresses between external electrode 4a and 4b. VL And lamp current IL Vibration arises and a wave motion can be excited inside the discharge plasma. In the case of this example, the luminous efficiency of a fluorescent lamp is about 20%. It improved.

[0012] The example from which the fluorescent lamp of this invention differs is explained based on the circuit diagram of drawing 3 . However, suppose that a same sign is attached about the configuration and equivalent configuration which were shown in drawing 1 . Although the external electrodes 5a and 5b were attached in the exterior of the lamp pipe 1 and it had connected with the pulse generating circuit 6 in the fluorescent lamp shown in drawing 1 , one side of an electrode which impresses a pulse voltage is made into internal electrode 2b in this example. Thus, also by constituting, a wave motion can be excited inside the discharge plasma as well as the case of the example shown in drawing 1 , and it is about 20%. The improvement in effectiveness was found.

[0013]

[Effect of the Invention] As mentioned above, according to the fluorescent lamp according to claim 1 or 2, a wave motion is excited inside the discharge plasma by impressing the pulse voltage of a repeat to the external electrode prepared in the lamp pipe exterior. Since 254nm intensity of radiation can be made to increase, improvement in effectiveness of a fluorescent lamp can be aimed at.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the circuit diagram showing one example of the fluorescent lamp of this invention.

[Drawing 2] It is the wave form chart showing the voltage waveform of the fluorescent lamp of this invention, a current wave form, or a pulse-voltage wave.

[Drawing 3] It is the circuit diagram showing the example from which the fluorescent lamp of this invention differs.

[Description of Notations]

1 Lamp Pipe

2a, 2b Internal electrode

5a, 5b, 7 External electrode

6 Pulse Generating Circuit

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[Translation done.]

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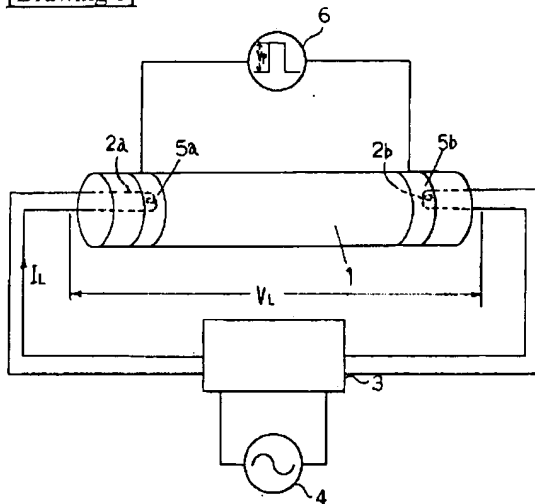
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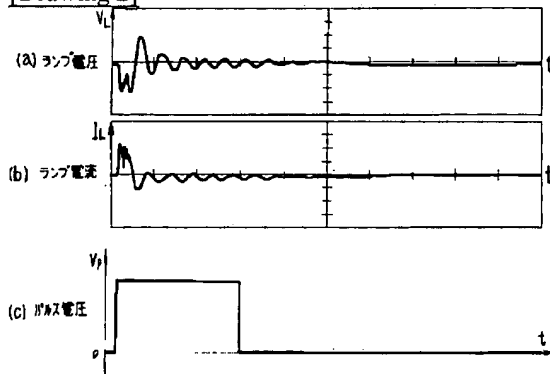
DRAWINGS

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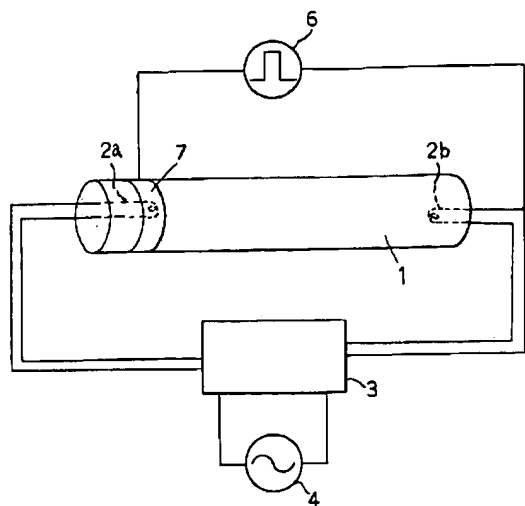
[Drawing 1]



[Drawing 2]



[Drawing 3]



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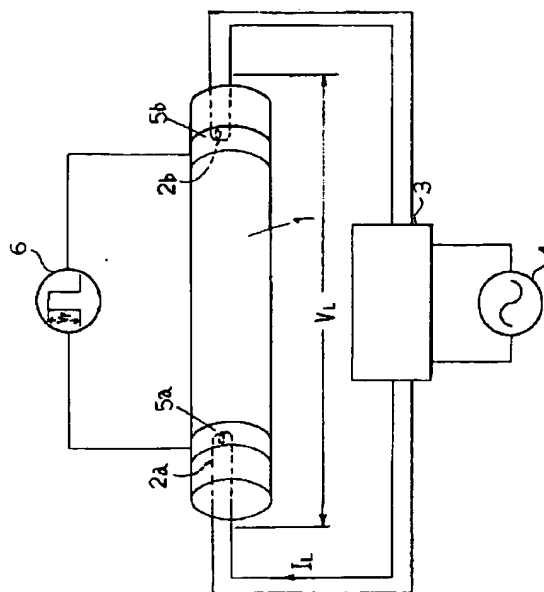
(54) 【発明の名称】 蛍光ランプ

(57) 【要約】

【目的】 蛍光ランプの大幅な効率向上を図る。

【構成】 一对の内部電極2a、2bに印加される高周波電圧によって高周波点灯される蛍光ランプにおいて、ランプ管1の外側の内部電極2a、2b近傍位置に一对の外部電極5a、5bを備えと共に、放電プラズマ内部に波動を励振するためのパルス電圧を外部電極5a、5b間に印加するパルス発生回路6を備えた。

【効果】 外部電極にパルス電圧を印加して放電プラズマ内部に波動を励振することにより254nm放射強度が増加して発光効率が向上する。



## 【特許請求の範囲】

【請求項1】 一对の内部電極に印加される高周波電圧によって高周波点灯される蛍光ランプにおいて、ランプ管の外側の前記内部電極近傍位置に一对の外部電極を備えると共に、放電プラズマ内部に波動を励振するためのパルス電圧を前記外部電極間に印加するパルス発生回路を備えたことを特徴とする蛍光ランプ。

【請求項2】 一对の内部電極に印加される高周波電圧によって高周波点灯される蛍光ランプにおいて、ランプ管の外側で、前記内部電極の一方の近傍位置に外部電極を備えると共に、放電プラズマ内部に波動を励振するためのパルス電圧を前記外部電極と一方の前記内部電極間に印加するパルス発生回路を備えたことを特徴とする蛍光ランプ。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】本発明は、水銀と希ガスが管内に封入された、いわゆる蛍光ランプに関するもので、特にランプ効率を向上させる方法に関するものである。

## 【0002】

【従来の技術】水銀と希ガスが管内に封入された、いわゆる蛍光ランプにおいて、現在、得られている最高効率は、高周波点灯専用蛍光ランプにおいて 100lm/W程度である。しかし、省エネルギーの観点より更なる効率の向上が望まれている。現在、行われている高効率化のためのアプローチとしては、ランプ寸法の最適化、高周波点灯に代表される点灯方式の最適化、蛍光体の発光効率の向上等である。

## 【0003】

【発明が解決しようとする課題】ただ、現状では上記の方法のみでは大幅な効率改善が容易でないという問題点があった。

【0004】本発明は上記課題に鑑みなされたもので、その目的とするところは、放電プラズマを積極的に制御することによって大幅な効率向上が図れる蛍光ランプの構造を提供することにある。

## 【0005】

【課題を解決するための手段】上記目的を達成するため、請求項1記載の蛍光ランプは、一对の内部電極に印加される高周波電圧によって高周波点灯される蛍光ランプにおいて、ランプ管の外側の前記内部電極近傍位置に一对の外部電極を備えると共に、放電プラズマ内部に波動を励振するためのパルス電圧を前記外部電極間に印加するパルス発生回路を備えたことを特徴とするものである。

【0006】また、請求項2記載の蛍光ランプは、一对の内部電極に印加される高周波電圧によって高周波点灯される蛍光ランプにおいて、ランプ管の外側で、前記内部電極の一方の近傍位置に外部電極を備えると共に、放電プラズマ内部に波動を励振するためのパルス電圧を前

記外部電極と一方の前記内部電極間に印加するパルス発生回路を備えたことを特徴とするものである。

## 【0007】

【作用】本発明の蛍光ランプは、チョークコイルまたはインバータ方式等で点灯される蛍光ランプにおいて、ランプの管の外部に外部電極を設置し、その外部電極に所定の繰り返しパルス電圧を印加することを特徴とするものである。このように構成することによって、管内のプラズマ内部にエネルギーの電子を生成することができる。この電子によって水銀をよりエネルギー準位の高い準位に励起することができる。この高いエネルギー準位に励起された水銀がパルス電圧の休止時間に紫外線の放射を行う。これは、一般に言われているパルス放電におけるアフターグローと同じ現象であり、印加パルスの条件を最適化すれば、パルス印加中よりも大きな放射強度を得られることが知られている。

【0008】また、外部電極にパルス電圧を印加することにより、図3に示すように、内部電極間の放電の電圧波形、電流波形に振動が生じる。この振動は放電プラズマ内部に波動が励振されていることを表しており、この波動が存在することにより、254nm放射強度が増加する。

## 【0009】

【実施例】本発明の蛍光ランプの一実施例を図1の回路図に基づいて説明する。図1で、水銀及び希ガスが封入されたランプ管1の内部には一对の内部電極2a、2bが設置されており、その内部電極2a、2bはそれぞれ、チョークバラストまたはインバータ方式等の点灯回路3に接続されている。点灯回路3は商用電源4から交流電力を入力している。ランプ管1外側の内部電極2a、2bの近傍の位置には、外部電極5a、5bがそれぞれ取り付けられており、それらの外部電極5a、5bは、パルス発生回路6に接続されている。

【0010】以上のように構成して、チョークバラストまたはインバータ方式等の点灯回路3によって内部電極2a、2b間に高周波電圧を印加すると共に、パルス発生回路6により外部電極5a、5b間に周波数が40Hz程度のパルス電圧を印加する。この時の内部電極2a、2b間の電圧または電流の波形は図3に示すようになる。

【0011】図3で、(a)は内部電極2a、2b間に印加されるランプ電圧  $V_L$  を表す電圧波形、(b)は内部電極2a、2b間に流れるランプ電流  $I_L$  を表す電流波形、(c)は外部電極5a、5b間に印加されるパルス電圧  $V_p$  を表す電圧波形である。図3に示すように、(c)に示すようなパルス電圧  $V_p$  を外部電極4a、4b間に印加した場合、(a)、(b)に示すように、ランプ電圧  $V_L$  及びランプ電流  $I_L$  に振動が生じて放電プラズマ内部に波動を励振することができる。本実施例の場合、蛍光ランプの発光効率は約20% 向上した。

【0012】本発明の蛍光ランプの異なる実施例を図3

3

の回路図に基づいて説明する。但し、図1に示した構成と同等構成については同符号を付すこととする。図1に示した蛍光ランプでは、外部電極5a、5bをランプ管1の外部に取付けてパルス発生回路6に接続していたが、本実施例では、パルス電圧を印加する電極の一方を内部電極2bとしている。このように構成することによっても、図1に示した実施例の場合と同様に、放電プラズマ内部に波動を励振でき、約20%の効率向上がみられた。

【0013】

【発明の効果】以上のように、請求項1または請求項2記載の蛍光ランプによれば、ランプ管外部に設けた外部電極に繰り返しのパルス電圧を印加することによって放電プラズマの内部に波動を励振して254nm放射強度を増

4

加させることができるので蛍光ランプの効率向上を図ることができる。

【図面の簡単な説明】

【図1】本発明の蛍光ランプの一実施例を示す回路図である。

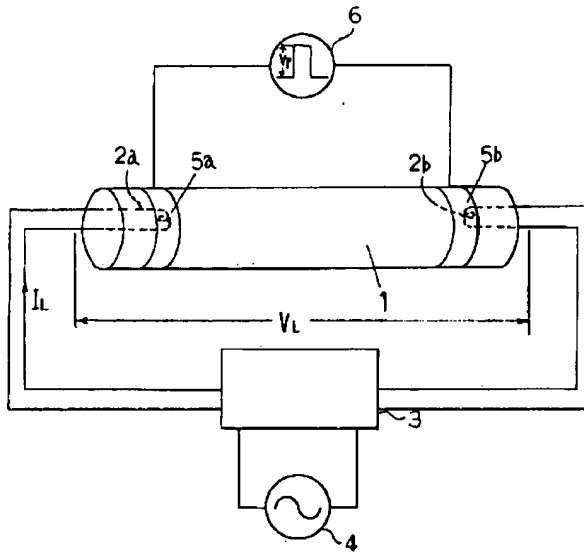
【図2】本発明の蛍光ランプの電圧波形または電流波形またはパルス電圧波形を示す波形図である。

【図3】本発明の蛍光ランプの異なる実施例を示す回路図である。

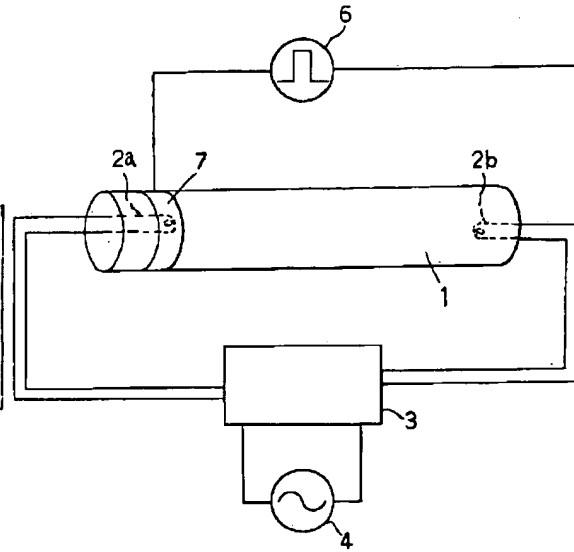
10 【符号の説明】

- |           |         |
|-----------|---------|
| 1         | ランプ管    |
| 2a, 2b    | 内部電極    |
| 5a, 5b, 7 | 外部電極    |
| 6         | パルス発生回路 |

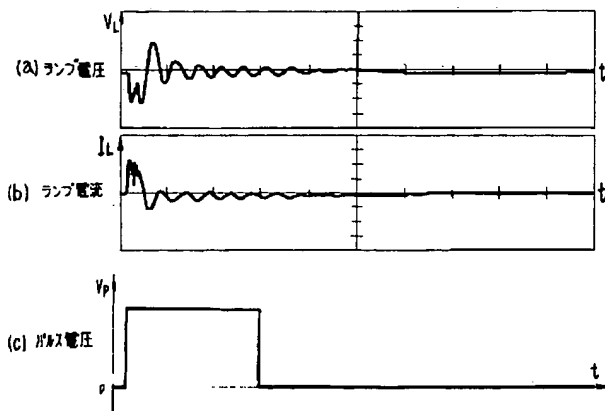
【図1】



【図3】



【図2】



PAT-NO: JP407272672A  
DOCUMENT-IDENTIFIER: JP 07272672 A  
TITLE: FLUORESCENT LAMP  
PUBN-DATE: October 20, 1995

INVENTOR-INFORMATION:

NAME

TAGUCHI, NORIYUKI  
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ASSIGNEE-INFORMATION:

NAME

MATSUSHITA ELECTRIC WORKS LTD

COUNTRY

N/A

APPL-NO: JP06063267

APPL-DATE: March 31, 1994

INT-CL (IPC): H01J061/04, H05B041/24

ABSTRACT:

PURPOSE: To enhance the efficiency of a fluorescent lamp to a great extent.

CONSTITUTION: A fluorescent lamp is high-frequency lighted with a high frequency voltage impressed on a pair of internal electrodes 2a, 2b, wherein a pair of external electrodes 5a, 5b are installed on the outside of the tube 1 in positions near the internal electrodes 2a, 2b, and further a pulse generating circuit 6 is furnished to impress a pulse voltage between the external electrodes 5a, 5b, and thereby a wave motion is excited in a discharge plasma. Accordingly the 254-nm emission intensity can be

increased by  
impressing pulse voltage on the external electrodes for  
excitation of wave  
motion in the discharge plasma, and the light emitting  
efficiency is enhanced.

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